Non Toxic solvents, sustainable materials, pollution control

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Abstract: Industrial activities rely heavily on conversional solvent and materials that are often toxic, non biodegradable ,and environmentally persistent.substances significantly contribute to air, water and soli pollution, risk to ecosystem and human health.

The role of non toxic solvent and sustainable materials in pollution control strategies.It is placed on green solvents such as water, bio-based solvents, Ionic liquids and deep eutectic solvent as well as sustainable materials including biopolymers and recyclable composites ,The environmental benifits, industrial applications, challenges,and future prospects of adopting these alternatives are discussed.The study highlights that integrating non -toxic solvents with sustainable materials can significantly reduce pollution while supporting sustainable Industrial development.

Keywords: No -toxic solvents,green chemistry,sustainable materials, pollution control, environmental sustainability

1) **introduction:** Rapid industrialization has led to increased environmental pollution solvents such as benzene , Toluene and chlorinated hydrocarbons are knows for their toxicity volatility,and persistence in the environment.In response, green chemistry principles promote the development of non toxic solvents and sustainable materials to minimize environmental impact.This paper examines how these alternatives contribute to effective pollution control while maintaining industrial efficiency

2) Non toxic solvents: Non toxic solvents are substances that exhibit low toxicity, reduced, volatility,and minimal environmental persistence

Types of Non toxic solvent

Water environmental benign and widely available

Bio-based solvents eg ethanol, ethyl acetate

Ionic liquids low vapour pressure and high thermal stability

Deep eutectic solvents biodegradable and cost effective

Environmental Benefits

Reduction in volatile organic compound emissions

Lower risk to human health

Enhanced recyclability and reuse

3) sustainable materials a designed to reduce resource consumption and environmental harm across their life cycle

Types of sustainable materials

: Biopolymers

Recycled and recyclable materials

Natural fibre composites

Role in pollution control

. Decreased plastic waste

.Reduced energy -consumption during production

. Improved biodegradability and end of life management

4) Integration of non- toxic solvent and sustainable material in pollution control.

The combination use of non- toxic solvent and sustainable material enhances pollution prevention by

* Reducing Hazardous waste generation.

* Enabling cleaner manufacturing processes.

* Supporting circular economy principles.

Industries such as pharma ceuticalls , coating, textile and electrics have shown measurable reduction environmental emissions through these approaches.

5) challenges and limitations

Despite their advantages challenge.

* High initial cost of some green solvents.

* Limited large scale industrial data .

* performance limitations compared to conventional materials.

6) Future prospects

Advancements in green chemistry , material science and biotechnology are expected improve the efficiency and affordability of non-toxic solvents and sustainable materials. Increased regularity pressure and consumer awareness will further drive their adoption for pollution control.

Conclusion

Non - toxic solvents and sustainable to modern pollution challenges . Their integration into industrial processes xan significantly reduced environmental contamination while supporting sustainable development. Continued research and collaboration between academic, industry and policy makes are essential to realise their full potential.

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